CPM3 9.1.3.docx

Monday, March 24, 2025   11:20 AM

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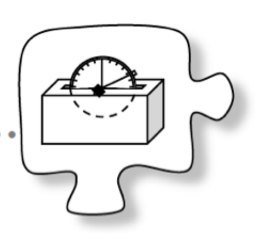
9.1.3 How are circles and sine graphs connected?

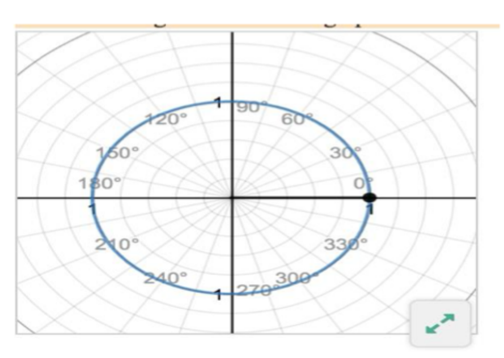


Unit Circle ↔ Graph

Throughout this course, you have used multiple representations (table, graph, equation, and situation) to solve problems, investigate functions, and justify conclusions. In the previous lesson you found that the circle you created to represent a wheel is one way to generate the graph of the sine function. The circle you used had a radius of 1 unit so it is called a unit circle. Today, you will investigate the connections between the unit circle and the graph of the sine function as you deepen your understanding of both.

Table
Graph   Equation
Unit Circle

9-27. On your paper draw a circle centered at the origin. Then draw a triangle that could represent René and Antonio's position on the wheel when *The Screamer* came to a sudden stop. Be sure to choose a different position from any of those you drew in problem 9-12. Explore this using *9-27 Student eTool* (Desmos). Click in the lower right corner of the graph to view it in full-screen mode. Desmos Accessibility



a. Label the triangle with its height and its angle measure (from 0º).

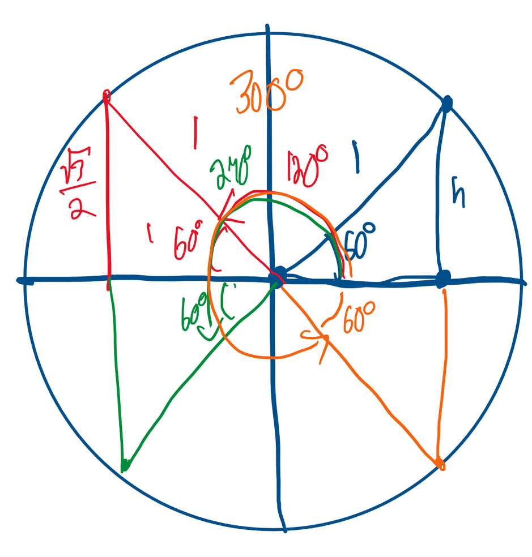
assume they were at 60°

$\sin(60) = \frac{\sqrt{3}}{2}$

$180 - 60 = 120$

$180 + 60 = 240$

$240 + 60 = 300$



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b. Did any other riders have to climb the same distance to get to safety (up *or* down) as René and Antonio did? If so, draw the corresponding triangles and label them completely.

c. What is the relationship between these triangles? The angle in the first quadrant is called the reference angle. Work with your team to generalize a method for determining all of the other corresponding angles when you are given just one angle.

need to clarify w/ class TWPS

They all have the same reference angle being 60°.

9-28. In problem 9-27, you used a unit circle to calculate the height of a seat on *The Screamer*. Can you use your graph of $y = \sin(\theta)$ instead to determine the height?

yes. y = height of $\Delta = \sin\theta$

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Use the Lesson 9.1.3 Resource Page (also called a sine calculator) or *9-28 Student eTool* (Desmos) to determine the height of a seat that has rotated 130º from the starting platform. Click in the lower right corner of the graph to view it in full-screen mode. Desmos Accessibility

$100 \sin(130)^\circ \approx 77$

77 ft

a. Are there any other seats at exactly the same height? If so, indicate them on your resource page.

Yes 50°, 310°, and 230°

$180 - 130 = 50$
$180 + 130 = 310$
$360 - 130 = 230$

b. How can you use the graph to calculate which angles correspond to seats with the same height? Discuss this with your team and be prepared to share your strategies with the class.

Horizontal lines that intersect the curve

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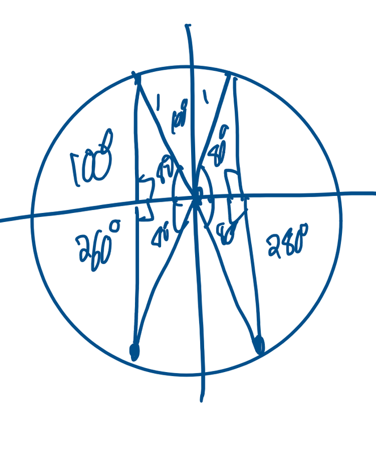
c. For each of the following angle measures, use the sine calculator from the resource page to determine the corresponding height and to locate another angle with the same corresponding height. Then sketch a small unit circle, draw in each pair of angles, and label their heights.

i. 80º   *ii.* 200º   *iii.* 310º

i. 80º



$180 - 80 = 100$
$180 + 80 = 260$
$360 - 80 = 280$

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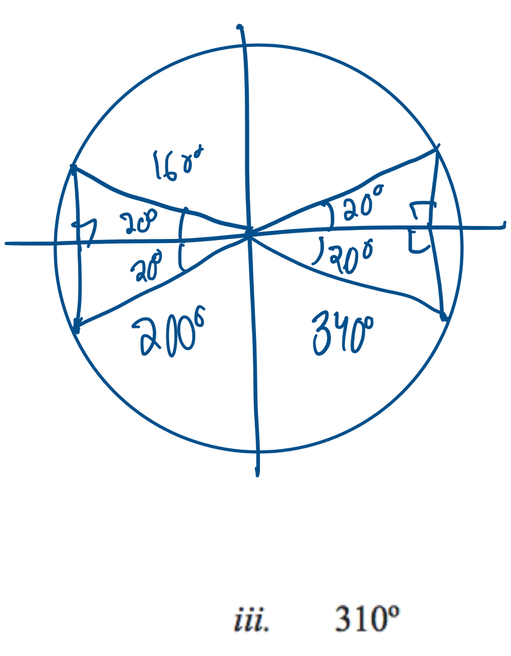
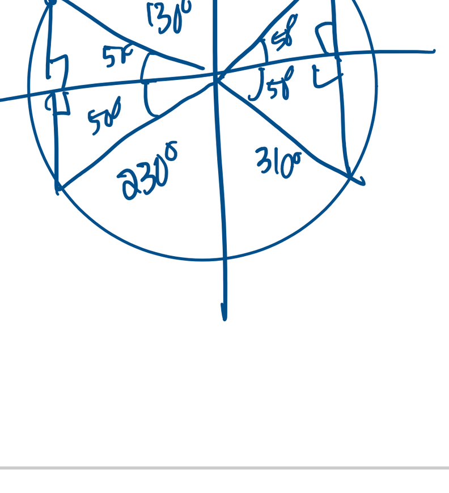
ii. 200º



$200 - 180 = 20^\circ$
$200 + 180 = 380^\circ$
$360 - 200 = 160^\circ$
$180 + 160 = 340^\circ$

$180 + 160 = 340$

iii. 310º



$310 - 180 = 130^\circ$
$180 - 130 = 50^\circ$
$130 + 180 = 310^\circ$
$180 + 50 = 230^\circ$